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One-dimensional, Multidimensional and Unidimensional Perspectives in a Multifunctional Device: Comparison of Three Models

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Abstract

Although a significant body of research on the acceptance of information systems has been conducted, few studies look at the acceptance of multifunctional devices. This study provides three models for analysing various functions within the device. The first model is the multifunctional one-dimensional model where factors are evaluated separately by each function. The second model, the enhanced multifunctional one-dimensional model, analyses factors not only by the function, but also theoretically formulates the relationship among intentions. The last model, the multidimensional model with unidimensional subconstructs, aggregates constructs from the same functions to measure higher level factors, i.e., constructs in the device level. The models are tested using a survey method. This study concludes that the latter two models offer an opportunity for researchers and practitioners to decide whether to evaluate each factor separately by each function and/or to aggregate constructs from the same functions to measure higher level factors.

Keywords

Multifunctional Device, Competitive Model, Smartphone, Mobile Phone, Survey Methodology

INTRODUCTION

Many of today's information technology products are designed to be multifunctional. Examples are mobile phones that include calendar scheduling and camera function; printer devices which include scanners, fax machines and Wi-Fi; laptops which include webcams, and wireless devices (e.g. bluetooth, Wi-Fi, infrared red), and touch screen; To our knowledge, there are very few studies examining the adoption of individual functions of multifunctional device and their relationships with the overall device. Specifically, user adoption models such as the theory of planned behaviour (TPB), expectation disconfirmation theory (EDT) and technology acceptance model (TAM) have been widely used to measure the adoption of a system such as email, personal computer, and library systems holistically (Davis 1989; Davis et al. 1989; Hong et al. 2006b). Although some studies have examined multifunctional devices, none of these previous studies looks into the relationships among the functions within the device and examined how the function-level analyses contribute to the understanding of the acceptance of the overall device.

This study examines one of the multifunctional devices, the smartphone, and assesses its four different functions: telephone, organizer, mp3 player and camera. According to the International Data Corporation's (IDC) Worldwide Quarterly Mobile Phone Tracker, in the third quarter of 2008, smartphone manufacturers shipped 41.5 million units of smartphones; in the same quarter in 2009, the number of shipments increased by more than 1 million units to reach over 43.3 million units (IDC 2009a). Although IDC showed that though mobile phone shipments fell by 15.8 percent in the first quarter of 2009, smartphone shipments were still up by 4 percent (IDC 2009b). Gartner also predicts that although smartphones currently account for 14 percent of overall mobile device sales, smartphones will make up about 37 percent of global handset sales by 2012. The smartphone revenue will also reach more than US$190 billion by 2012, higher than end user spending on mobile PCs, which is forecast to reach about US$150 billion in 2012 (Gartner 2009). By 2013, mobile phones will overtake PCs as the most common Web access device worldwide (Gartner 2010). These numbers show that smartphones will become more important to our lives in the near future.

Due to the importance of the topic, additional work that analyses various functions and the relationships among the functions of such a device would be necessary. Our research objective is to examine the relationships among various functions within the smartphone by comparing different research models. Specifically, we seek to understand whether a particular model offers a better explanation for the acceptance of functions and their relationship to the overall device.

The current article is organized as follows. The first section provides brief background information on smartphones. The section followed explains the three models examined in this paper. This is followed by a brief review on the theory applied to examine the model. The methodology section describes the instrument

development and data collection, followed by the data analysis section. The subsequent section discusses the findings and implications. The paper is concluded with some suggestions for future research.

BACKGROUND

Smartphone

A smartphone is a PC-mobile convergence handheld device. It is a phone with various functions such as a date book, address book, task list, and memo pad. Nowadays, functions such as organizer, word processor, spreadsheet, game, browser, and mp3 player are quite common, accordingly, it is also known as a PDA phone (PDA which includes a phone function) (Ballagas et al. 2006). To be consistent, we use the term smartphone referring to smartphone and PDA phones throughout the study.

Four different functions in the smartphone: telephone, organizer, mp3 player and camera are analysed in this study. More advanced smartphones even include touch screen, Wi-Fi for the Internet connection and GPS (global positioning system) functions. A number of professions including business, education (Yuen and Yuen 2003), engineering (Tseng et al. 2004) and medicine (McLeod et al. 2003) have been using smartphone extensively. Consumer demand for PDAs without phone and a phone without various functions dwindle with the tendency to shift towards more smartphones (Newsland 2007).

The Three Models

Currently, smartphones incorporate many diverse functions. Most user acceptance studies, however, continue to analyse the systems in a holistic manner. Our review shows that interest has been increasing in studying user acceptance of multifunctional devices at a functional level. A literature review on user acceptance studies examining multifunctional devices shows that these studies can generally be classified into three models. The first two existing models focus on examining individual functions and extending the links to include the relationship among various intentions. The last model analyses functions and their relationships to the device using multidimensional constructs, particularly it specifies formative and reflective sub/constructs for the device and each function respectively. The following subsections elaborate on the three models in detail.

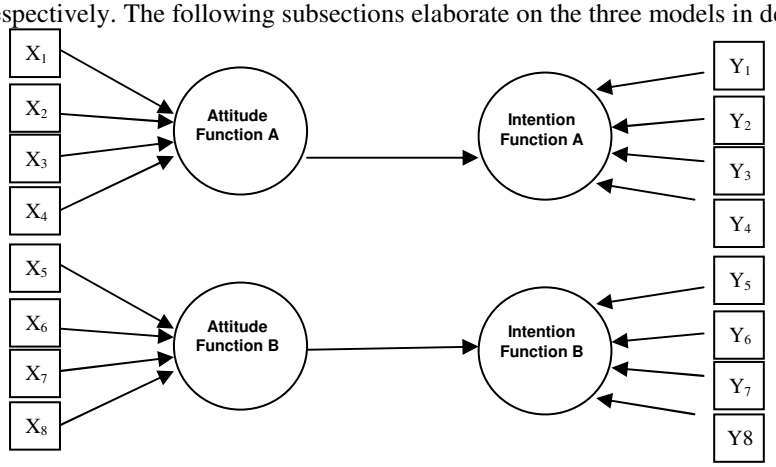

Figure 1: The Multifunctional One-dimensional Model

The Multifunctional One-dimensional Model

The first model, as in the studies by Hong et al. (2006a), Hong et al. (2006b), and Lin and Chan (2003), examines each function separately (Please see Figure 1. for detail). For instance, Lin and Chan (2003) examined two functions in the Amazon website, namely search and purchase. They hypothesized that perceived usefulness for search function (PU for search) and perceived ease of use for search function (PEOU for search) are positively related to intention to use the search function (INT for search) and PU for purchase and PEOU for purchase is positively related to INT for purchase. Similarly, Hong et al. (2006a; 2006b) tested three different mobile data services: communications, information content and entertainment services. Each perceived ease of use, perceived usefulness, perceived enjoyment, perceived cost and need for uniqueness of data services was hypothesized to have a positive influence on the intention of its respective data service.

We call this model a multifunctional one-dimensional model because multiple models (e.g., multiple TPBs) are implemented based on functions (e.g., the TPB for phone consists of the relationship between attitude for phone and intention for phone; the TPB for organizer consists of the relationship between attitude for organizer and

intention for organizer and so on) and each factor is measured as a single dimension (e.g., attitude for phone function, attitude for organizer function are measured as single dimensions).

The Enhanced Multifunctional One-dimensional Model

The second model, as in the studies by Shim et al. (2001), Pavlou and Fygenson (2006), and Lin and Chan (2009), does not only examine each function separately, but it also hypothesizes the relationships of factors across two or more functions (Please see Figure 2. for the example). For instance, Pavlou and Fygenson (2006) hypothesized search constructs to have effects on intention to search, and purchase constructs to have effects on intention to purchase (i.e., similar to the previous model, multifunctional one-dimensional model). They also added the link between the two intentions and behaviours. Specifically, they hypothesized that purchase intention has a positive effect on search intention and search behaviour has a positive effect on purchase behaviour -- the relationships of factors across the functions. Similarly, Shim et al. (2001) also predicted that intention to search has an influence on intention to purchase. Lin and Chan (2009) further hypothesized PEOU for search and PU for search to have an effect on PEOU for purchase and PU for purchase respectively. To simply this model, we follow Shim et al. (2001) and Pavlou and Fygenson which hypothesized only the relationship between intentions.

We call this model the enhanced multifunctional one-dimensional model because the model does not simply measure multiple TPBs as the previous model does, but it also considers the relationships of factors across the functions (e.g., intention to search → intention to purchase).

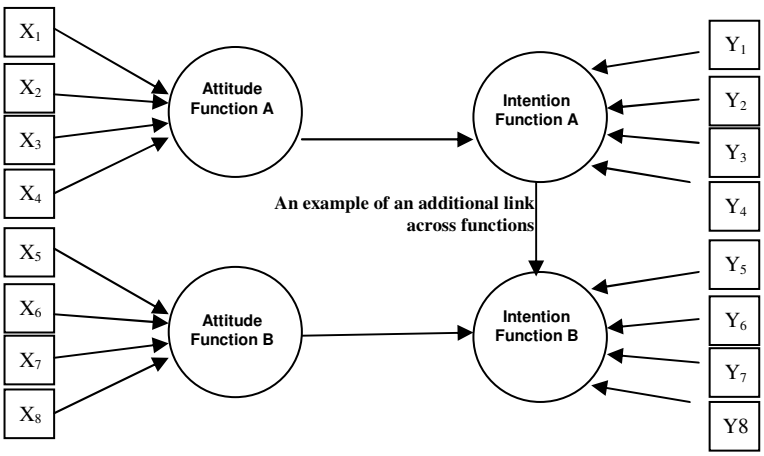

Figure 2: The Enhanced Multifunctional One-dimensional Model

The Multidimensional Model with Unidimensional Subconstructs

The last model observes the multidimensionality and unidimensionality of the constructs. Multidimensional and unidimensional constructs are opposites. A unidimensional construct is a reflective construct that measures the same aspect of the unobservable construct (e.g., attitude for phone is measured by the favourable/unfavourable and positive/negative feeling toward the phone). On the other hand, a multidimensional construct is *usually* considered as a formative construct since it consists of more than one dimension. For instance, attitude for smartphone (i.e., a multidimensional construct) consists of different attitude dimensions such as attitude for phone, attitude for organizer, and attitude for mp3 player. However, as illustrated by Petter et al. (2007), not all multidimensional constructs are formative. A multidimensional construct may have a formative relationship with subconstructs (i.e., attitude for smartphone has a formative relationship with subconstructs such as attitude for phone, attitude for organizer and attitude for other functions), yet the subconstructs consist of reflective items (i.e., attitude for phone, attitude for organizer and attitude for other functions are unidimensional constructs measured by reflective items).

We call this model the multidimensional model with unidimensional subconstructs since the model consists of multidimensional formative subconstructs (e.g., attitude for the device [η_4] is measured by formative subconstructs i.e., attitude for different functions [e.g., η_1, η_2, η_3]) which subsequently are measured unidimensionally using reflective indicators [Y_1, Y_2, Y_3...Y_{12}] at the functional level (Please see Figure 3 for detail).

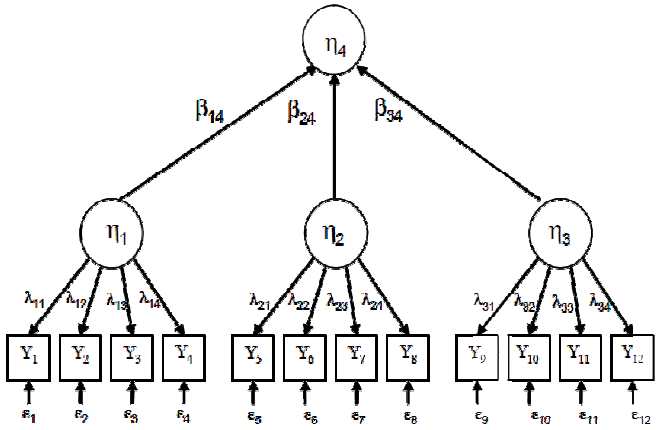

Figure 3: The Multidimensional Model with Unidimensional Subconstruct (Adapted from Petter et al. 2007)

Application of the Theory of Planned Behaviour to the Competitive Models

To examine and analyse the three models closely, we apply the theory of planned behaviour (the TPB) (Ajzen 1991). The theory of planned behaviour (TPB) consists of five constructs: attitude, subjective norm, perceived behavioural control, intention and behaviour. The TPB hypothesizes that behaviour is influenced by one's intention to perform the behaviour and perceived behavioural control. Intention, on the other hand, is influenced by one's attitude, subjective norm and also by perceived behavioural control. In this study, we use four constructs of the TPB: attitude, subjective norm, perceived behavioural control and intention. Many previous studies have established the causal link between intention and behaviour (e.g., Taylor and Todd 1995; Venkatesh et al. 2000). For instance, Sheppard et al. (1988) showed a correlation of 0.53 between intention and behaviour in their meta-analyses. We should also highlight that the theory we presented here is intended solely for illustrative purposes which aim to test different models to examine a multifunctional device. Researchers may apply other theories to closely examine these models.

RESEARCH METHDOLOGY

Consistent with prior research in user acceptance studies (Hong et al. 2006b; Perugini and Bagozzi 2001; Thong et al. 2006), a survey was employed for data collection. Instrument development and survey administration are discussed in the following sections.

Instrument Development

Most instruments were adapted from previous research. Specifically, two items for intention, two items for subjective norm, four items for perceived behavioral control (PBC), and four items for attitude were adapted from Ajzen and Fishbein (1980). The adapted questions were specific and consistent with respect to action (intention to use), target (smartphone function), context (work and life), and time (in the next 4 weeks) as recommended by Ajzen and Fishbein (1980). All items were rated using a 7-point Likert scales.

The questionnaire was pre-tested by two researchers and a small group of graduate students. The purpose of the pretest was to check the content validity and to enhance the clarity and readability of the questionnaire. In addition, a pilot test was conducted to further check the reliability and validity. We invited 30 respondents from a major smartphone retail outlet. Except for the last item from PBC, the results suggested all items adequate reliability and validity. Thus, we adopted only three items for PBC, and retained other items from the pilot study. The final questionnaire is available from the author.

Data Collection

To decide on suitable subjects (i.e., the smartphones owner), a customer intercept survey was conducted in Singapore. The survey was conducted for a two-week period by two trained researchers who intercepted subjects passing by to request if they would be willing to participate in a brief research study. After an initial screening to check eligibility requirements (i.e., whether the subject owned a smartphone), subjects were asked to participate in the survey. To improve the response rate, an incentive of about US$7 cash was offered to each respondent upon his/her completion of the questionnaire. After the survey, additional cash of about US$70 was provided to two respondents with valid answers via a lucky draw.

The survey was administered to 240 subjects, and finally 213 responses were usable. Among the respondents, 161 were male (75.6%) and 52 were female (24.4%). The respondents' age ranged from 13 to 64 years old, with an average of 33 years. Specifically, the average of males was 34 years and that of females was 32. Professions

indicated by the respondents mainly include: senior manager, technician, engineer, educator, consultant, students and self-employed. The survey by Newsland (2007) showed that smartphone users were mostly males in all surveyed regions (male users range from 58% to 78%). More than 50% of smartphone users in Europe and the US were also between the ages of 30 and 50. The survey also showed that a vast majority of respondents belong to the business sphere and refer themselves to different levels of management. Occupations popular among smartphone users were: business owners, managers, students, temporary unemployed and others. A comparison shows that the demographics of our respondents and that of Newsland survey are similar. Hence, the obtained sample of this study may be regarded as reasonably representative of smartphone users.

Data Analysis

The research models described in Figure 1, 2 and 3 were analysed using SPSS version 13.0 and Partial Least Squares (PLS graph version 3). SPSS 13.0 was used to analyse the descriptive statistics, and PLS was used, instead of LISREL or AMOS, as it places minimal restrictions on scales and residual distribution (e.g., no requirement needed to specify the error terms between the same constructs in different functions). It is also suitable for large numbers of constructs and items. PLS could also assess the measurement model and the structural model simultaneously in one operation (Chin 1998; Pavlou and Fygenson 2006). It was also used to analyse the average variance extracted for testing measurement models. For testing structural models (i.e. the path coefficients in PLS), t-values were assessed with a nonparametric test of significance known as bootstrapping.

RESULT

Measurement Model

Without specifying any relationships among the constructs, PLS graph was run to assess the measurement model. All measurement items showed adequate reliability, convergent and discriminant validity. Table 1 shows that all items have significant loadings at the 0.0001 level. All measures fulfilled the recommended levels of composite reliability (ρC) and average variance extracted (AVE). For instance, all items in the model are higher than recommended value of 0.50 (Fornell and Larcker 1987). Not only all constructs for the model show high composite reliabilities, but also the average variances extracted are very high at 0.73 and above (see Table 1).

Table 1. Measurement Model

Item	Loading	Mean of subsample	Std. error	T-Stats
Overall Device				
Attitude (Reliability=0.94; AVE=0.80)				
AttPD1	0.88	0.87	0.03	31.18
AttPD2	0.94	0.94	0.01	92.91
AttPD3	0.91	0.90	0.02	39.99
AttPD4	0.85	0.85	0.04	24.03
Subjective Norm (Reliability=0.95; AVE=0.91)				
SnPD1	0.95	0.96	0.01	101.44
SnPD2	0.95	0.96	0.01	101.44
Perceived Behavioral Control (Reliability=0.89; AVE=0.73)				
PbcPD1	0.85	0.85	0.03	26.53
PbcPD2	0.85	0.86	0.03	31.12
PbcPD3	0.86	0.86	0.03	32.37
Intention (Reliability=0.99; AVE=0.98)				
IntPD1	0.99	0.99	0.00	381.28
IntPD2	0.99	0.99	0.00	381.28
MP3 Player Function				
Attitude (Reliability=0.99; AVE=0.95)				
AttMP1	0.97	0.98	0.01	155.13
AttMP2	0.98	0.98	0.00	276.04
AttMP3	0.97	0.97	0.01	115.59
AttMP4	0.96	0.96	0.01	95.47
Subjective Norm (Reliability=0.99; AVE=0.99)				
SnMP1	0.99	0.99	0.00	758.19
SnMP2	0.99	0.99	0.00	751.60
Perceived Behavioral Control (Reliability=0.98; AVE=0.93)				
PbcMP1	0.98	0.98	0.01	193.05
PbcMP2	0.96	0.96	0.01	64.20
PbcMP3	0.96	0.96	0.01	87.73
Intention (Reliability=0.99; AVE=0.99)				
IntMP1	1.00	0.99	0.03	30.49
IntMP2	1.00	0.99	0.02	44.65

Item	Loading	Mean of subsample	Std. error	T-Stats
Phone Function				
Attitude (Reliability=0.96; AVE=0.87)				
AttPH1	0.94	0.94	0.02	61.18
AttPH2	0.93	0.93	0.02	40.65
AttPH3	0.94	0.94	0.02	45.11
AttPH4	0.92	0.92	0.02	52.23
Subjective Norm (Reliability=0.98; AVE=0.97)				
SnPH1	0.98	0.98	0.00	237.76
SnPH2	0.98	0.98	0.00	237.76
Perceived Behavioral Control (Reliability=0.96; AVE=0.88)				
PbcPH1	0.94	0.94	0.02	61.03
PbcPH2	0.95	0.95	0.01	80.68
PbcPH3	0.93	0.93	0.02	45.43
Intention (Reliability=0.99; AVE=0.98)				
IntPH1	0.99	0.99	0.01	176.47
IntPH2	0.99	0.99	0.01	176.47
Camera Function				
Attitude (Reliability=0.98; AVE=0.91)				
AttCM1	0.97	0.97	0.00	213.80
AttCM2	0.94	0.95	0.01	67.02
AttCM3	0.97	0.97	0.01	153.93
AttCM4	0.94	0.94	0.01	70.88
Subjective Norm (Reliability=0.99; AVE=0.98)				
SnCM1	0.99	0.99	0.00	558.72
SnCM2	0.99	0.99	0.00	558.72
Perceived Behavioral Control (Reliability=0.96; AVE=0.90)				
PbcCM1	0.95	0.95	0.01	81.43
PbcCM2	0.95	0.95	0.01	90.16
PbcCM3	0.93	0.93	0.02	49.01
Intention (Reliability=0.99; AVE=0.98)				
IntCM1	0.99	0.99	0.00	420.70
IntCM2	0.99	0.99	0.00	420.70

Item	Loading	Mean of subsample	Std. error	T-Stats
Organizer Function				
Attitude (Reliability=0.97; AVE=0.90)				
AttOR1	0.95	0.94	0.01	65.52
AttOR2	0.96	0.96	0.01	119.30
AttOR3	0.95	0.95	0.01	74.38
AttOR4	0.95	0.95	0.01	101.04
Subjective Norm (Reliability=0.97; AVE=0.94)				
SnOR1	0.97	0.97	0.01	113.02
SnOR2	0.97	0.97	0.01	113.02

Item	Loading	Mean of subsample	Std. error	T-Stats
Perceived Behavioral Control (Reliability=0.95; AVE=0.86)				
PbcOR1	0.95	0.95	0.01	128.97
PbcOR2	0.93	0.93	0.01	69.57
PbcOR3	0.90	0.89	0.02	48.90
Intention (Reliability=0.99; AVE=0.99)				
IntOR1	0.99	0.99	0.01	152.29
IntOR2	0.99	0.99	0.01	152.29

Structural Model

Figure 4, 5 and 6 show the results of the multivariate tests of structural models with the path coefficients, t-statistics, and amount of variance explained (R2). As shown in Figure 4, the result of the multifunctional one-dimensional model indicates that most of the path coefficients in the model are highly significant ($p<0.001$) or significant ($p<0.05$).

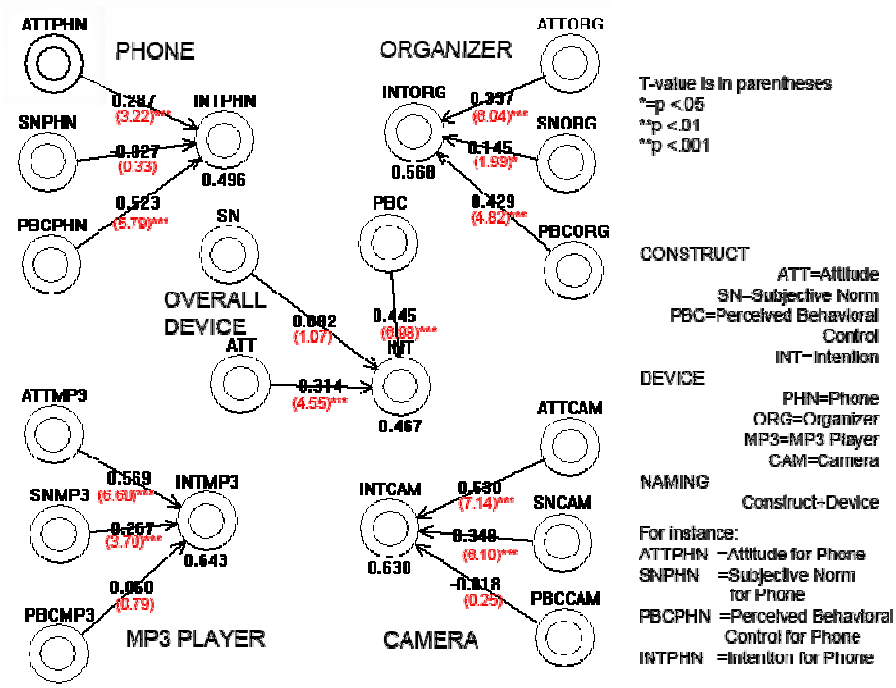

Figure 4: The Structural Result for the Multifunctional One-dimensional Model

Specifically, the explained variances in all intentions are above 46 percent. The lowest explained variance in the function-level intention is about 50% (i.e., intention for phone). The explained variance in intention to use organizer by all TPB predictors is 57 percent. For both mp3 player and camera functions, attitude and subjective norm have significant effects on intention accounting for more than 60 percent of the variance in their respective intention. Perceived behavioural control, however, is not a significant predictor of intention in both functions. More than 46 percent of the variances in phone function and the overall smartphone device are explained by attitude and perceived behavioural control, but not by subjective norm.

Except for the additional paths from the function-level intentions to the overall device (i.e., intention to use phone, organizer, mp3 players, and camera to intention to use the overall device) and a path from subjective norm for organizer to intention to use organizer which is not supported, but is marginally supported in the previous model, the result of the enhanced multifunctional one-dimensional model is the same as the multifunctional one-dimensional model. Specifically, not only the factors which influence intention to use phone, organizer, mp3 players and camera are identical (except for the path from subjective norm to intention to use organizer as mentioned above), the r-squares for intention to use phone, organizer, mp3 players and camera are also the same. Intention to use the smartphone (i.e., the overall device) is explained by attitude and perceived behavioural control, and the amount of variance explained is high at around 60 percent (c.f. only 47 percent in the previous model). This shows that attitude and perceived behavioural control of the overall device account for significant amounts of variance explained in intention to use the overall device.

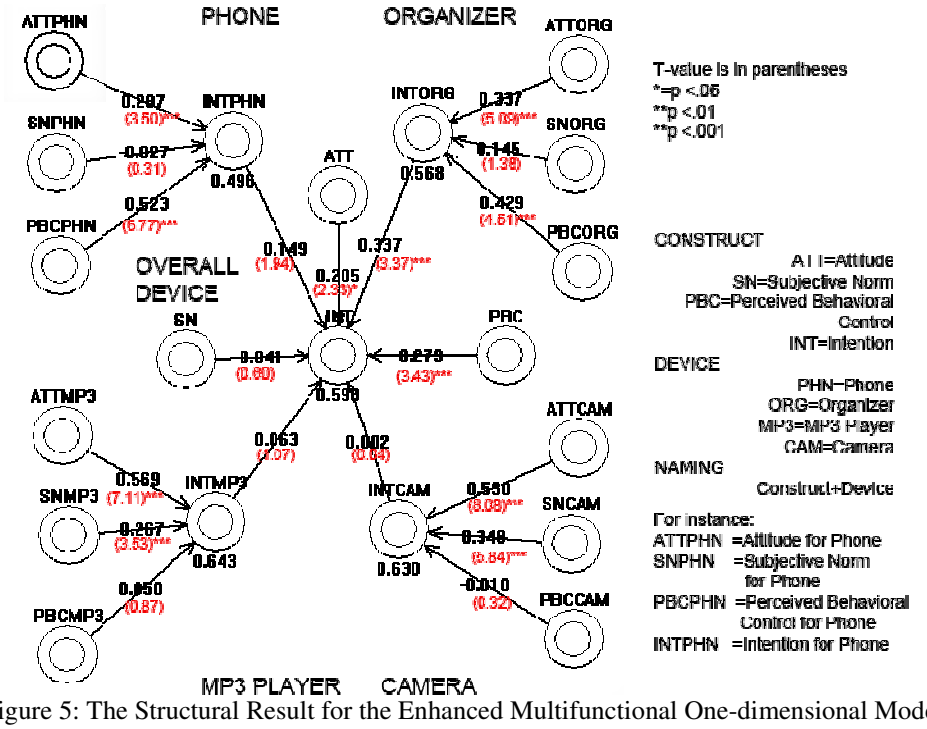

Figure 5: The Structural Result for the Enhanced Multifunctional One-dimensional Model

For the last model (i.e., the multidimensional model with unidimensional subconstructs), the result shows that the TPB exogenous constructs within the functional level can explain around 34 to 60 percent of the variation in the TPB endogenous constructs in the device level. Within the functional level, constructs related to phone and organizer functions, but not those related to mp3 player and camera, have significant effects on constructs on the device. For instance, attitude for phone and attitude for organizer have significant effects on attitude for the device. Similar, subjective norm for phone and organizer, perceived behavioural control for phone and organizer and intention for phone and organizer have significant effects on subjective norm for the device, perceived

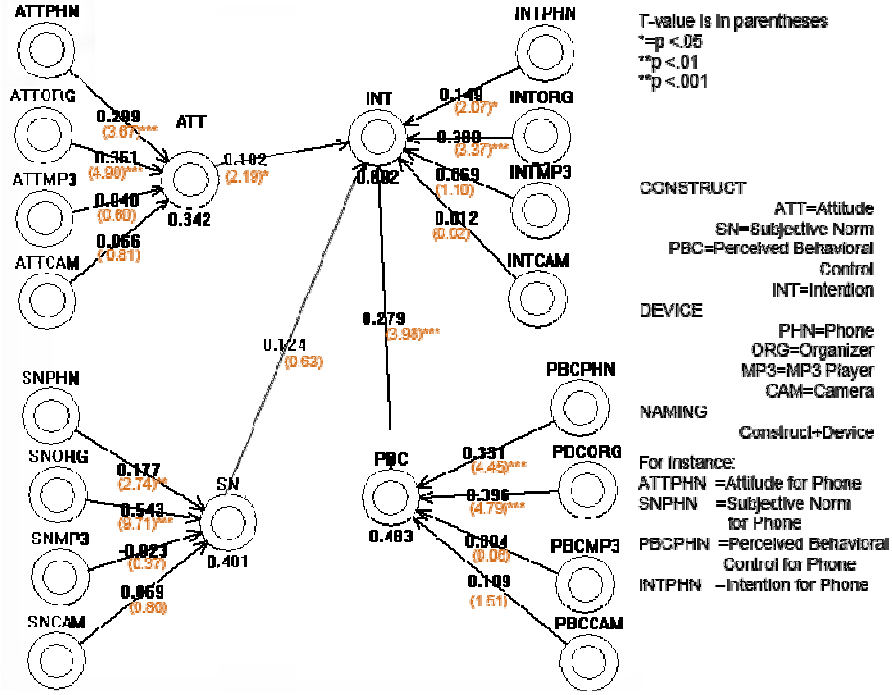

Figure 6: The Structural Result for Multidimensional Model with Unidimensional Subconstructs

behavioural control for the device and intention for the device respectively. For TPB constructs in the device level, attitude for the device and subjective norm for the device have positive effects on intention to use the device, but subjective norm for the device does not have any significant effects on intention to use the device.

DISCUSSION

This study is one of the pioneers that thoroughly investigates the role of various functions in a multifunctional device and their relationships with the overall device. Specifically, we draw upon previous studies which have examined the multifunctional information systems and propose two function-level models: the multifunctional one-dimensional model and the enhanced multifunctional one-dimensional model. Furthermore, based on an existing study which examined formative and reflective constructs, we propose another model: the multidimensional model with unidimensional subconstructs. The results show that the explained variances in intentions ranges from 34 to 64 percent, and most of the hypotheses are supported by the survey data.

Before we discuss the results and implications, it is important to highlight several limitations of the study. First, the data in this study was collected using a mall intercept method, the results of this study are somewhat limited to users in a modern city. The generalizability of the study to other individuals with different demographic characteristics may require caution. Second, our results may also be limited to the point of time where and when the study was conducted. As newer smartphone models appear, many newer functions may be integrated into the device and intention to use each of the functions may be different.

The multifunctional one-dimensional model provides an overview of factors affecting each function. In this model, attitude is the only factor which has a positive effect on intention in all functions. Subjective norm is not a significant predictor of intention in the phone function and the overall device (t-values were 0.33 and 1.07 respectively). Interestingly, perceived behavioural control is not a significant factor affecting intention to use the mp3 player and the camera function (t-values were 0.79 and 0.25 respectively). Probably, the camera function and the mp3 player function in the smartphone are too easy for users and they do not give much room to control the features. For instance, the camera does not allow users to use advanced features such as changing the depth of field or lenses of the camera. Future research should look at these relationships.

Besides highlighting factors which influence intention to use each function, the enhanced multifunctional one-dimensional model offers more explanation about whether intention to use a specific function could influence the overall intention to use the device. Specifically, the enhanced multifunctional one-dimensional model does not only show that attitude, subjective norm and perceived behavioural control in each function can explain a reasonable amount of the variance in function-level intentions, but the model also demonstrates which function-level intentions are important to intention to use the device. Surprisingly, although the function-level factors can explain about 50 percent and above of the variance in the function-level intention, none -- but only intention to use the organizer function -- has a significant influence on intention to use the device. The manufacturers of such a device need to include more advanced features for its mp3 player and camera function so that they can indirectly influence intention to use the device.

The result for multidimensional model with unidimensional subconstructs shows that all factors in the phone and organizer functions have significant influences on the factors in the device level (i.e., higher level factors). Specifically, attitude for phone and attitude for organizer have positive effects on attitude for the overall device; perceived behavioural control for phone and perceived behavioural control for organizer have positive effects on perceived behavioural control for the overall device; intention to use phone and intention to use organizer have positive effects on intention to use the overall device; subjective norm for phone and subjective norm form organizer also have positive effects on subjective norm for the overall device. However, the effects of subjective norm for these functions do not result in a significant effect upon intention to use the device. Intention to use the device is driven only by intention to use the phone and organizer functions as well as attitude and perceived behavioural control for the overall device.

Compared to the enhanced multifunctional one-dimensional model and the multidimensional model with unidimensional subconstructs, the explained variance in intention to use the device in the multifunctional one-dimensional model is relatively low. In particular, the r-squares for intention to use the device in two latter models are almost similar at about 60 percent while the r-square for the same construct in the former model is only about 47 percent (i.e., there is an increase of more than 27 percent). At the same time, both latter models offer a richer understanding of a multifunctional device as discussed above.

These results offer new insights into the study of a multifunction device and offer research and practice implications. Specifically, previous research in user acceptance has mostly looked at different functions "independently without any attempt to capture the extent of their relationships" (Pavlou and Fygenson 2006, p. 118). This paper attempts to answer the call to understand distinct functions in a multifunctional device and examine the interrelationships among them in the framework of the TPB. This paper contributes to the social psychology literature by extending the TPB, specifically by theoretically broadening the TPB to include functional constructs in the enhanced multifunctional one-dimensional model and by deepening the theory to

examine the interrelationships among constructs at the functional level in the multidimensional model with unidimensional constructs (e.g., Perugini and Bagozzi 2001).

To broaden the TPB, this study includes additional variables -- intentions at the functional level (i.e., intention to use phone, organizer, mp3 and camera) -- as parallel predictors of the endogenous variable (i.e., intention to use the overall device), together with the established variables including attitude, subjective norm, and perceived behavioural control of the overall device. Besides adding these variables, this paper also sets a boundary condition on the theory as such to predict which intention variables (i.e., intention to use phone, organizer, mp3 and camera) have higher impacts on intention to use the overall device. In particular, we are interested in the distinct roles of the function-level intentions. The effects of the established variables on the dependent variables are also replicated and the results confirmed previous studies. These results are promising and contribute to a better understanding of the role of functions and the TPB in general.

To deepen the TPB, this study introduces a theoretical mechanism, which enables the effects of existing predictors to be better understood by making constructs from the overall device (e.g., attitude, subjective norm and perceived behavioural control in the overall device) to serve as mediating variables between a range of predictors (attitudes, subjective norms and perceived behavioural controls in the functional level/sub-functions) and the overall intention. The result sheds light on the importance of examining the acceptance of the overall device by constructs at the functional level, and has a significant theoretical contribution to the TPB.

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